

***Dactylobiotus luci*, a new freshwater tardigrade (Eutardigrada: Macrobiotidae) from the Rwenzori Mountains, Uganda**

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A new freshwater eutardigrade, *Dactylobiotus luci* sp. nov., is described from a permanent marsh pool (Zaphania's Pool) at 4225 m elevation in the Alpine zone of the Rwenzori Mountains, Uganda. The new species is most similar to *D. dervizi* Biserov, 1998 in the shape of the egg processes, absence of papillae and absence of eyes, but differs from it mainly by a different appearance of macroplacoids, by having tips of the egg processes usually sharp, not divided and more slender, and by several morphometric characters of eggs and adults. The new species was found in fairly acidic (pH < 6) *Sphagnum-Carex* fens bordering/extending into the pool. So far, it has only been recorded in one other high-elevation water body in Rwenzori in a similar habitat.

Key words: Tardigrada, *Dactylobiotus dervizi*, *Dactylobiotus luci* sp. nov., alpine pool, Rwenzori, Uganda.

INTRODUCTION

Compared to other areas, the African tardigrade fauna is poorly known with only 21 of the 54 countries having records (about 200 species; Biserov 1994; Binda & Pilato 1995; Binda *et al.* 2001, Jørgensen 2001; Kaczmarek *et al.* 2006; Kaczmarek & Michalczyk 2004; Pilato *et al.* 2002, 2003, 2004, 2006). To date, only a few freshwater tardigrades have been described from Africa, and only two of them belong to the genus *Dactylobiotus*, namely *D. dispar* and *D. macronyx* (McInnes 1994).

The genus *Dactylobiotus* Schuster, 1980 is widespread throughout the world and contains 14 properly described species (the taxonomic position of *D. macronyx* (Dujardin, 1851) is still unclear) (Binda & Pilato 1999; Biserov 1998; Guidetti *et al.* 2006). Two of them, *D. aquatilis* Yang, 1999 and *D. henanensis* Yang, 2002, are in need of revision since taxonomically important characters have not been described (Yang 1999, 2002).

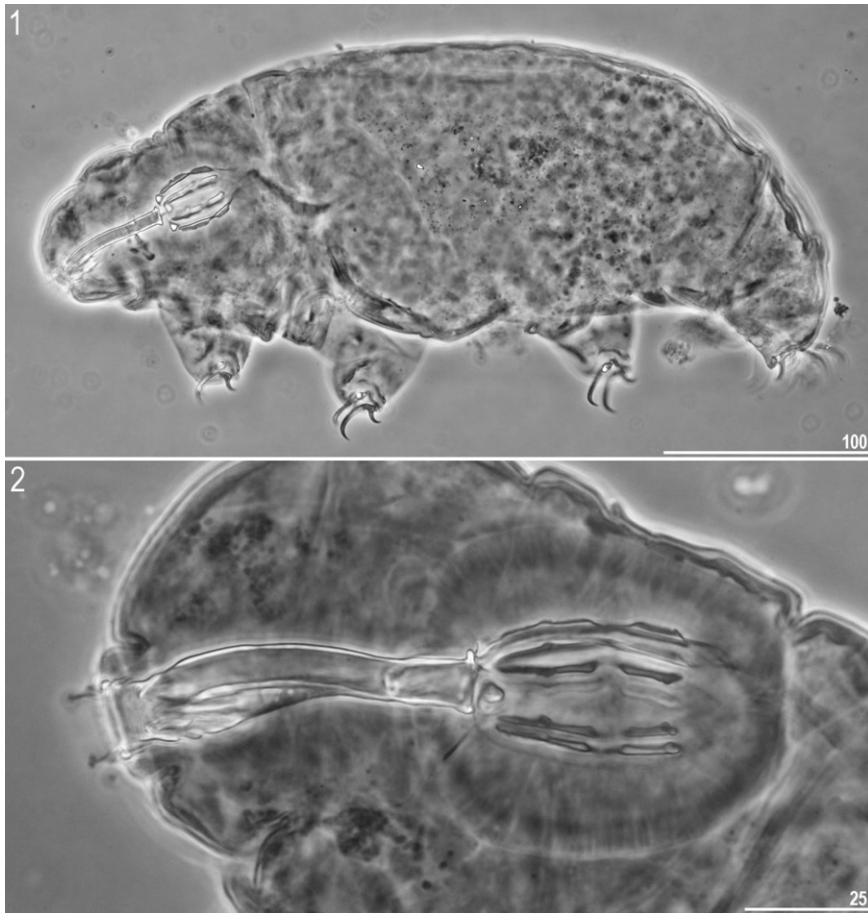
In this paper, *Dactylobiotus luci* sp. nov. is described from a permanent marsh pool at 4225 m a.s.l. in the Alpine zone of the Rwenzori Mountains, Uganda. A recent study exploring the geographical diversity patterns of the African tardigrade fauna (Jørgensen 2001) indicated that the East African

Mountains are likely to be the most species diverse regions on the continent. In contrast to Mount Kilimanjaro (e.g. Binda & Guglielmino 1991) and Mount Kenya (e.g. Löffler 1968; De Smet & Bafort, 1990), the tardigrade fauna of the Rwenzori Mountains has never received proper attention; only one species (*Macrobiotus kurasii* Dastych, 1980) has been described from this region (Dastych 1980). A comprehensive survey of the tardigrade fauna in virtually all lakes and pools on the Ugandan side of the range (see Eggermont *et al.* 2007 for detailed description) is currently under way, and may reveal more unknown species.

MATERIALS & METHODS

The tardigrades were sampled by sweeping a zooplankton net (50 µm mesh) in the *Carex-Sphagnum* fens extending into Zaphania's Pool and by squeezing the mosses. Specimens were preserved in 90% ethanol. In this study, 39 specimens and 12 eggs of *Dactylobiotus luci* sp. nov. were analysed. All measurements are given in micrometres (µm). Structures were measured only if their orientations were suitable. Body length was measured from the anterior extremity to the end of the body, excluding the hind legs. Buccal tube length and the level of the stylet support insertion

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Figs 1–2. *Dactylobiotus luci*. 1, Habitus (adult, lateral mid-section); 2, buccal apparatus (lateral view).

point were measured according to Pilato (1981). Buccal tube widths were measured as the external and internal diameters at the level of the stylet support insertion point. Claw lengths were measured according Binda & Pilato (1999). Only external (anterior in case of claws IV) claws were measured. The *pt* ratio is the ratio of the length of a given structure to the length of the buccal tube, expressed as a percentage (Pilato 1981). In the description of the holotype, the *pt* ratio is given after μm value (in square brackets and in *italics*). All photomicrographs were made using Phase Contrast Microscope (PCM). Measurements of the species used in differential diagnosis are given or calculated according to Ramazzotti & Maucci (1983), Binda & Pilato (1999), Biserov (1998), Dastych (1984) and Pilato & Binda (1994). *D. aquatilis* and *D. henanensis* are not included in the differential diagnosis due to their inadequate descriptions (see also Introduction).

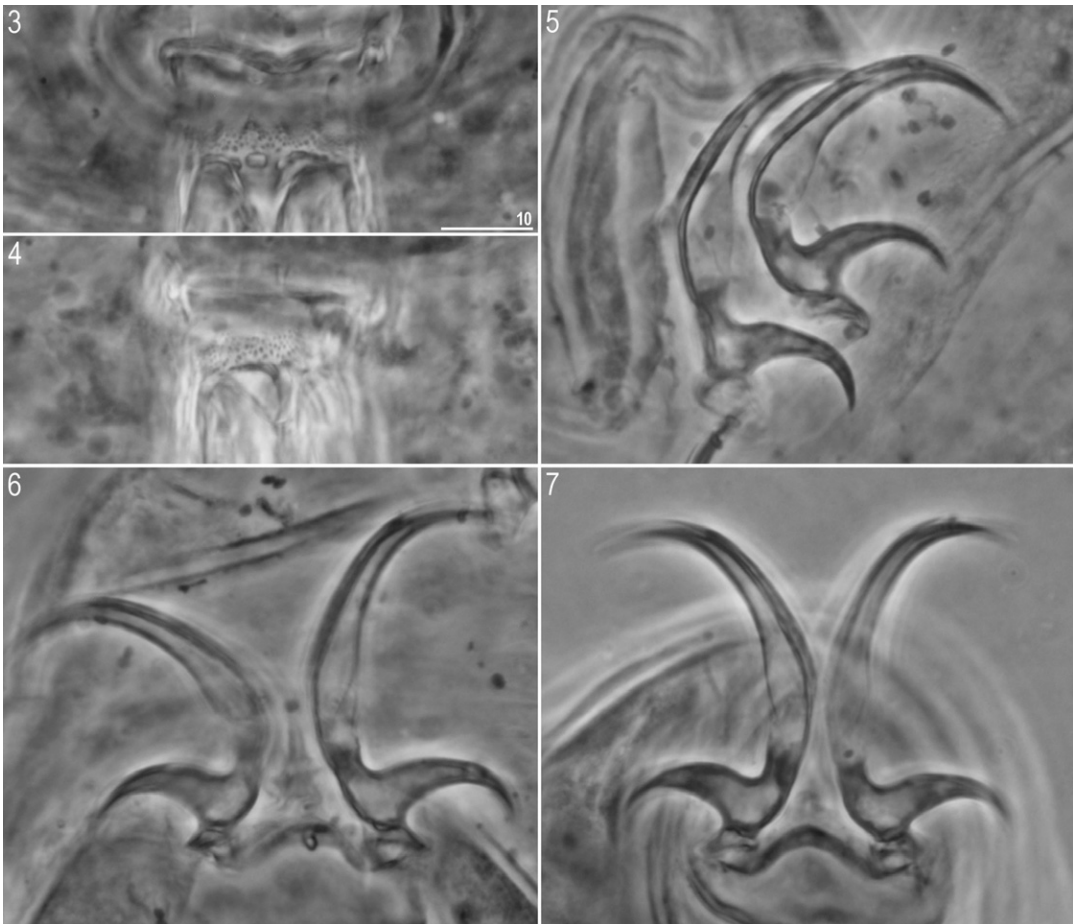
TAXONOMIC ACCOUNT

Dactylobiotus luci n.sp., Figs 1–10

Material examined. Holotype (No. 52a/1) and 38 paratypes (No. 52a/2–4) and 12 eggs (including two with embryos) (No. 52a/1 and 52a/4): Rwenzori Mountains, Uganda, Africa. Combined zooplankton/zoobenthos samples collected from *Carex-Sphagnum* fens extending into Zaphania's Pool, 0°18.385'N and 29°53.080'E, 13 July 2005, leg. Hilde Eggermont and Kay Van Damme (Ghent University, Belgium). For more details on the study site see Eggermont *et al.* (2007).

Description of holotype. Body length 484.0. Body colour yellow, eyes absent (Fig. 1). Cuticle smooth, without gibbosities, papillae, spines or sculpture. Bucco-pharyngeal apparatus of the *Macrobiotus* type with ventral lamina and ten peribuccal lamellae (Fig. 2). Peribuccal papulae absent.

Mouth antero-ventral. Oral cavity armature well



Figs 3–7. *Dactylobiotus luci*. 3–4, Oral cavity armature: 3, ventral teeth; 4, dorsal teeth. 5–7, Claws: 5, claw I; 6, claw II; 7, claw III. Scale for Figs 4–7 same as in Fig. 3 (μm).

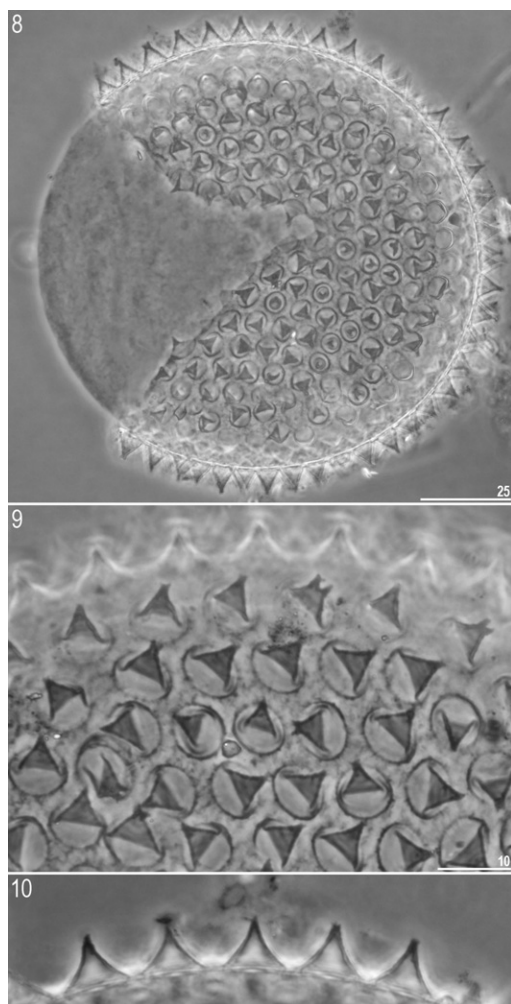
developed, consisting of two bands of teeth (Figs 3–4). First band of teeth in the anterior portion of the oral cavity absent.

Second band of teeth placed in the posterior portion of the oral cavity, just before the third band of teeth. This band is continuous and composed of 4–5 irregular rows of small, dense teeth. Teeth in shape of round or slightly oval granules/cones (spaces between teeth usually as wide as teeth themselves) (Figs 3–4). This band is continuous and looks the same on all oral cavity walls. Third band of teeth arranged into two series (dorsal and ventral) (Figs 3–4). This band is positioned in the rear of the oral cavity just behind the second band of teeth and just before the buccal tube opening. Two ventro-lateral and two dorsolateral teeth are in the shape of transverse ridges. Ventromedian and dorsomedian tooth transversally oval with

rounded edges and distinctly separated from the ventro-lateral and dorsolateral teeth.

Buccal tube 54.0 long and 6.7 (12.4) (external) and 4.3 (8.0) (internal) wide. Ventral lamina 30.2 (55.9) long. Stylet supports inserted on buccal tube at 40.5 (75.0). At the end of the buccal tube, triangular pharyngeal apophyses present. Pharyngeal bulb spherical with two rod-shaped macroplacoids (with sharpened edges) situated very close one to another, almost in contact (length configuration 1–2). Microplacoid and septulum absent. First macroplacoid 16.5 (30.6) long (almost twice as long as the second), with central constriction and with central and subterminal projections. Second macroplacoid 8.4 (15.6) long, with subterminal constriction and anterior and subterminal projections. Macroplacoid row 28.0 (51.8) long.

Claws of *Dactylobiotus* type (2-1-1-2) similar in



Figs 8–10. *Dactylobiotus luci*. 8, Egg; 9, eggshell; 10, egg processes (mid-section). Scale for Fig. 10 same as in Fig. 9 (μm).

size and shape on all legs and with very short basal portions (Figs 5–7). Primary branches of claws with well developed accessory points. Lunules absent but robust semilunar, cuticular connection between external and internal claws present (Fig. 7). Claws on first three pairs of legs subequal in length but on fourth pair clearly longer. Claw lengths: leg I: total claw 23.2 (43.0) long, secondary branch 8.0 (14.8) long, secondary branch length/total claw length ratio 34.0%; leg II: tc 24.2 (44.8) long, sb 8.7 (16.1) long, sb length/tc length ratio 36.0%; leg III: tc 24.2 (44.8) long, sb 8.7 (16.1) long, sb length/tc length ratio 36.0%; leg IV: tc 36.5 (67.6) long, sb 12.3 (22.8) long, sb length/tc length ratio 34.0%.

Eggs. Large, yellow, laid freely. Spherical or slightly oval, without areolation, with 37–41 processes on the circumference (Fig. 8). Processes in the shape of short and wide cones (base diameter of each process greater than half of its height) (Figs 9–10, Table 2). Most of processes have single sharp tip; however some have two or three sharp tips. Occasionally processes may have blunt tips. Processes and surface between them smooth (without any granulation or areolation visible in PCM).

Remarks. Results of a simple statistical analysis of measurements and *pt* values of selected morphological structures for some specimens and eggs are given in Tables 1–2.

Etymology. *Dactylobiotus luci* sp. nov. is named after Professor Luc Lens (Ghent University, Belgium), who is a great source of motivation and inspiration for a new generation of young African scientists.

Type repositories. Holotype (No. No. 52a/1), 38 paratypes and 12 eggs are preserved at the Department of Animal Taxonomy and Ecology, A. Mickiewicz University, Umultowska 89, Poznań, Poland.

Other records. This species has so far only been recorded in Zaphania's Pool and Lake Kopello (4017 m asl), both located on the Ugandan side of the Rwenzori Mountain range, where it occurs in fairly acidic ($\text{pH} < 6$) *Sphagnum-Carex* ferns bordering/extending into the water bodies. In Lake Kopello, it occurred alongside *Thulinus ruffoi* (Bertolani, 1982) and *Murrayon cf. pullari* (Murray, 1907).

Differential diagnosis. *Dactylobiotus luci* sp. nov. is the most similar to *D. dervizi* Biserov, 1998 in the shape of egg processes, absence of papillae as well as in the absence of eyes, but differs from it by: a different shape of macroplacoids (the first macroplacoid with a central constriction and with central and subterminal projections, the second with a subterminal constriction and with anterior and subterminal projections in *D. luci* and the first macroplacoid with a central projection, the second with a subterminal constriction in *D. dervizi*), a higher *pt* of the buccal tube width (12.4–15.7 in *D. luci* and 9.7–11.3 in *D. dervizi*), a different appearance of egg processes (tips with sharp or blunt ends, only occasionally furcated with two or rarely with three very short tips in *D. luci* and tips of processes bi-, tri- or multifurcated and often divided into short branches in *D. dervizi*), narrower bases of processes (5.2–7.1 in *D. luci* and about 9.0 in

Table 1. Measurements (in μm) and *pt* values of selected morphological structures of specimens of *Dactylobiotus luci* mounted in Hoyer's medium (Range refers to the smallest and the largest structure found among all measured specimens; *n*, number of specimens/structures measured, S.D., standard deviation; tc, total claw, sb, secondary branch).

Character	<i>n</i>	Range		Mean		S.D.	
		μm	<i>pt</i>	μm	<i>pt</i>	μm	<i>pt</i>
Body	7	445.0–717.0	857.7–926.4	576.0	888.0	110.6	31.3
Buccal tube	7	53.4–77.4	–	68.6	–	10.6	–
Stylet support insertion point	7	39.5–57.4	73.8–75.8	51.2	74.7	7.9	0.8
Buccal tube external width	7	6.6–12.0	12.4–15.7	9.8	14.1	2.2	1.3
Buccal tube internal width	7	4.2–9.4	7.9–12.3	6.7	9.6	1.8	1.5
Ventral lamina	7	28.0–40.0	49.7–55.9	36.1	52.8	4.9	2.2
Macroplacoid 1	7	16.5–25.9	30.6–33.6	22.2	32.2	4.0	1.1
Macroplacoid 2	7	8.4–16.0	15.6–20.7	13.1	19.0	3.0	1.7
Macroplacoid row	7	28.0–45.0	51.9–58.1	38.4	55.7	7.2	2.3
Claw 1 – tc	7	22.1–38.4	41.2–50.3	29.3	45.0	7.1	3.7
Claw 1 – sb	7	7.5–12.4	14.0–16.3	10.0	15.3	2.2	1.0
Claw 2 – tc	6	22.7–37.8	41.7–49.5	28.9	45.0	6.4	3.1
Claw 2 – sb	6	8.2–12.7	15.4–16.4	10.3	16.1	2.1	0.4
Claw 3 – tc	6	22.5–38.8	42.1–51.9	29.2	45.6	6.8	4.1
Claw 3 – sb	6	8.4–14.0	15.7–18.7	10.7	16.7	2.3	1.2
Claw 4 – tc	5	32.5–51.3	60.9–67.6	40.1	65.4	7.9	3.1
Claw 4 – sb	5	12.1–18.5	22.7–23.9	14.2	23.2	2.9	0.6
Claw 1 – sb/tc length ratio	7	0.32–0.36	–	0.34	–	0.01	–
Claw 2 – sb/tc length ratio	6	0.33–0.39	–	0.36	–	0.02	–
Claw 3 – sb/tc length ratio	6	0.34–0.41	–	0.37	–	0.02	–
Claw 4 – sb/length ratio	5	0.34–0.37	–	0.35	–	0.01	–

Table 2. Measurements (in μm) of selected morphological structures of eggs of *Dactylobiotus luci* mounted in Hoyer's medium (Range refers to the smallest and the largest structure found among all measured eggs; *n*, number of eggs/structures measured, S.D., standard deviation).

Character	<i>n</i>	Range	Mean	S.D.
Diameter of egg without processes	7	101.1–141.0	122.5	13.2
Diameter of egg with processes	7	119.9–157.0	140.4	12.3
Processes height	21	6.6–10.4	8.4	0.9
Processes base width	21	5.2–7.1	6.4	0.6
Process base/height ratio	21	0.57–0.92	0.76	0.11
Distance between processes	21	1.5–4.2	2.8	0.7
Number of processes on the circumference of egg	7	37–41	39.0	1.4

D. dervizi), a larger number of processes on the circumference of egg (37–41 in *D. luci* and about 31–36 in *D. dervizi*).

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